RULER
Version 3.2a [August 6, 2007]

**Author:** Thomas W. Burrows
Energy Sciences and Technology Department
National Nuclear Data Center
Bldg. 197-D
Brookhaven National Laboratory
P.O. Box 5000
Upton, NY 11973-5000
Phone: 631-344-5084 FAX: 631-344-2806
Email: nndctb@bnl.gov

This program either calculates the reduced electromagnetic transition strengths and compares these to the Recommended Upper Limits (RUL) or calculates $BE\lambda W$ and $BM\lambda W$ for inclusion in ENSDF datasets. It is primarily designed to work on ADOPTED LEVELS, GAMMAS data sets but will process any data set whose DSID indicates the presence of gammas.

**Input file:** ENSDF formatted file. Sample input file: ruler.inp

## Output files:

1. The report file will list the data sets and note any problems or assumptions by the program. In the comparison mode it will show the calculations and compare the results to the RUL's noting possible violations. In the calculation mode it will show the calculations and compare the old and new values for $BE\lambda W$'s and $BM\lambda W$'s. Sample report files: ruler1.rpt (Comparison) and ruler2.rpt (Calculation).
2. Optionally a new file will be created containing the $BE\lambda W$'s and $BM\lambda W$'s calculated. Sample output file: ruler.out.
3. If a new file is created and problems have been encountered in processing the file, a file summarizing these problems will be produced. This file will have the same name as the output file with the extension "prob" (Example: myfile.out and myfile.prob). Sample output file: ruler.out.

## Terminal dialog:

The program will request the input and report file specifications, the mode of operation (case insensitive), and, optionally, the new file specifications.

In addition, the user will be asked for the uncertainty in $\alpha_{tot}$ to be assumed in the calculations:
1. HSICC: Assume 3% uncertainty to be added in quadrature (Default)
2. BRICC: Assume 1.4% uncertainty if $\Delta\alpha_{tot}$ not given
3. Other: the user will be requested to specify an uncertainty in percent to be assumed if $\Delta\alpha_{tot}$ not given

The progress of the program will be noted on the terminal. If problems are encountered, this will be noted.

## Command line mode:

The program may also invoked *via* the command line by entering ruler followed by a string with a leading per cent sign ("%") and the input parameters in the same order as in the terminal

dialog separated by "%". A blank (" ") or "#" specifies that the program default be used. For output files, "null" (case insensitive) will direct the output to the null device (/dev/null under Linux). A simple example is:

```
ruler <ENSDF filename>
```

This will process in the specified ENSDF file with the program defaults.

## Compilation and loading instructions:

This program requires subroutines from the NSDFLIB95 package.

## Additional documentation: ruler.pdf

## Version History

| | | |
|---|---|---|
| 1 | 04-Oct-1983 | Preliminary version. |
| 1.1 | 18-Feb-1984 | First exportable version |
| 1.2 | 13-Aug-1984 | Fixed errors and expanded |

    1. References now accounted for when obtaining BR from %IT
    2. BR obtained from N record for isomeric level in IT Decay data sets.
    3. Multipolarities sorted in ascending order.
    4. Expanded comparisons between old and new records.
    5. Cleaned up COMMON's

| | | |
|---|---|---|
| 1.3 | Jun-1986 | Use F77STR and NSDCNV libraries |
| 1.4 | 08-Aug-1986 | Add VAX MDC. |
| 1.5 | 14-Aug-1986 | Multipolarity field on G card |
| 1.6 | 17-Dec-1986 | 1. Fix undef. oper when BR blank. |
| | | 2. Add IBMPC MDC. |
| 1.7 | 10-Feb-1987 | Added check for embedded non-gamma radiations |
| 1.8 | 02-Nov-1987 | VAX MDC OPEN with READONLY for dataset |
| 1.9 | 15-Jun-1989 | Added checking to avoid floating overflows. If the result will be greater than $10^{38}$, value is set to $10^{38}$. |
| 1.10 | 19-Jan-1990 | DX2 modified. |
| 1.11 | 26-Apr-1990 | 1. Rewrote subroutine READIN |

        a. Corrected bug, which caused wrong translation of values on continuation records when followed by other quantities.
        b. Corrected logic problem that had been suppressing many messages.
    2. Added check for possible record length overflow in report.
    3. Other minor bug's fixed after running all ARCHIVAL ENSDF IT DECAY and ADOPTED LEVELS, GAMMAS data sets through RULER.

| | | |
|---|---|---|
| 1.12 | 15-Jun-1990 | Mods/cleanups in order to run on IBM PC Microsoft v5.0. - Use CNVU2S for BRTI *etc.*, Data statement position, NORM calling arguments, *etc*. |
| 1.13 | 04-Sep-1990 | In order to fit in IBM PC, subroutines READIN and OUT2 were broken into smaller routines, ADDMES, DOMESS and APPEND subroutines were eliminated and WRTRPT modified, COMMONs MESSN and MESSC were |

RULER
Version 3.2a [August 6, 2007]

added.

1.14   20-Dec-1990   Typo in READIN corrected. Added TYPST routine to check unacceptable chars.

| | | |
|---|---|---|
| 1.15 | 20-Apr-1993 | 1. Added ANS MDC |
| | | 2. Explicitly typed all variables and functions |
| | | 3. Replaced string concatenation with other methods (Problems on some compilers) |
| | | 4. Restored parameters I50, I51, and LINEMX for IPC to same as for other computers |
| | | 5. Delinted using FLINT 2.83 |
| 1.16 | 24-May-1993 | 1. Changed estimate of AP from 10% to 50% as per JKT and MJM |
| | | 2. Changed from assuming 50% admixture for mixed MULT.'s with no MR to giving upper limits assuming pure |
| | | 3. Corrected several logic errors which taken together gave incorrect results if an AP found on RI or TI |
| | | 4. Corrected minor output logic error in DUMP when END record encountered |
| | | 5. Added check for ampersand in column 77. Assume TI=DTI=(TI+DTI)/2 |
| | | 6. Removed assumption of parentheses for 'IF' in MULT field |
| | | 7. Correct out-of-bounds error in OUT2 |
| | | 8. Removed some redundant coding |
| | | 9. Added Date stamp to IBM PC |
| 1.16a | 06-Aug-1993 | 1. Corrected alignment problem for Alpha FORTRAN |
| | | 2. Removed two lines of never accessed coding |
| 1.17 | 16-Sep-1993 | Renormalization was not being done when there were approximate intensities |
| 1.18 | 29-Nov-1993 | 1. Added check for missing or nonnumeric $E_\gamma$ for insertion option |
| | | 2. Corrected logic errors in output of asymmetric uncertainties |
| 1.19 | 29-Apr-1994 | 1. Corrected more logic errors in output of uncertainties |
| | | 2. Do not calculate BElW's, BMlW's as per MJM and JKT |
| 1.20 | 13-Dec-1994 | Check for option 7 (% photon branching) on PN and calculate BR properly. |
| 1.20a | 06-Mar-1998 | 1. Corrected range error in OUT2ON |
| | | 2. Changed calls to VAX TIME/DATE routines to handle Y2K problem. |
| 1.20b | 21-Sep-1999 | Corrected logic problems in outputting asymmetric uncertainties |
| 1.3 | 07-Feb-2001 | Added UNX MDC coding. (RRK) |
| 1.31 | 09-May-2002 | 1. Not recognizing asymmetric DT's - Fixed. |
| | | 2. Some logic problems in storing +DT and -DT - Fixed. |
| | | 3. Problems with approximate T1/2's when preceded by asymmetric DT's - Fixed |
| 1.31a | 15-Jul-2002 | "2 G" records containing "BM1=",… confused program - Fixed and added note to report to check the record |
| 1.32 | 20-Oct-2004 | Not recognizing T1/2 limits - Fixed |
| 3.0 | 20-May-2004 | 1. Converted to Fortran 95 |
| | | 2. Command line input added |
| | | (CLD) |
| 3.1 | 28-Oct-2004 | Incorporated 1.32 revision of Fortran 77 version |

<div align="center">

RULER

Version 3.2a [August 6, 2007]

</div>

| 3.1a | 25-May-2006 | 1. Corrected problem which put program into infinite loop if Mode of Operation not entered correctly |
|---|---|---|
| | | 2. Added input dialogue asking for theoretical DCC to assume |
| | | 3. Corrected initialization problem which caused some uncertainties to be underestimated |
| | | 4. Corrected a couple of minor formatting problems in the report file |
| | | 5. Corrected problem in comparing old and new values when a limit or "AP" |
| 3.1b | 18-Oct-2006 | Corrected initialization problem caused in porting from F77 to F95 (<nul> in F95 instead of " " in F77 if string not initialized) |
| 3.1c | 30-Oct-2006 | 1. Correct some output formatting problems in OUT235 |
| | | 2. Increased length of sdx in OUT235 to handle asymmetric uncertainties |
| | | 3. Corrected omission of a few lines of code in OUT235 which caused asymmetric uncertainties to be underestimated |
| 3.2 | 23-Jul-2007 | 1. Added logic in attempt to correctly calculate values if $\Gamma$'s or very short $T_{1/2}$'s are given on Level records |
| | | 2. Completely rewrote logic for handling asymmetric uncertainties |
| | | 3. Added comparison of calculated BE$\lambda$W's and BM$\lambda$W's and noted discrepancies |
| | | 4. Checked to see if there was an existing BE$\lambda$W or BM$\lambda$W and missing MULT, MR, etc. |
| | | 5. Added four possible warnings to standard output: |
| | |     a. $T_{1/2}$'s in eV or as and insufficient data to derive gamma widths |
| | |     b. BE$\lambda$W or BM$\lambda$W found but no MULT, DPI unknown, or mixed MULT with no MR |
| | |     c. Problem with asymmetric uncertainties |
| | |     d. Some BE$\lambda$W's or BM$\lambda$W's exceed RUL |
| | |     Details given in report file |
| | | 6. Corrected problem for mixed transitions which led to an old transition probability be kept if the other value agreed with the new value |
| | | 7. Cleaned up some problems in the comparison mode which resulted confusion between IV and IS RUL's |
| | | 8. Cleaned up some formatting problems of new records |
| | | 9. Changed default for theoretical CC's from HSICC to BrIcc |
| | | 10. Corrected problem when input file name had leading blanks |
| | | 11. Cleaned up some formatting of messages in the report file |
| 3.2a | 06-Aug-2007 | (With input from Balraj Singh) |
| | | 1. Also added a check against RUL when old record kept |
| | | 2. Automatically create a new file summarizing problems when calculating new values |

<div align="center">

## Disclaimer

</div>

Neither the Brookhaven Science Associates, Inc., nor the US Department of Energy make any warranty or assume any legal responsibility for the results produced by the program.

RULER
Version 3.2a [August 6, 2007]